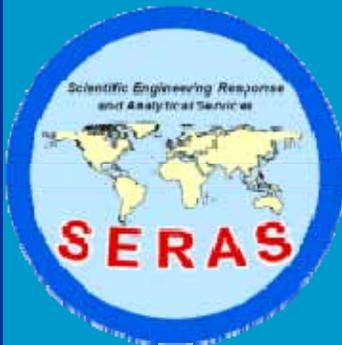


Environmental Response Team Standard Operating Procedures for Contaminated Water Diving Operations



AAUS March 2010 Meeting

Alan Humphrey, U.S. EPA/ERT
Scott Grossman, Lockheed Martin SERAS
Jon McBurney, Lockheed Martin SERAS





Environmental Response Team (ERT)

- Established in 1978
- 41 Experienced Responders
- 125+ Trained Contractors
- Focus: “Classic Environmental” Emergencies

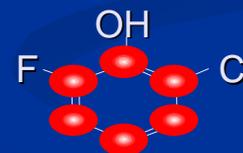
Sampling/monitoring

Hazard Evaluation

Risk Assessment/Safety

Characterization

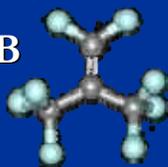
Decon/Disposal



2-chloro-6-fluorophenol



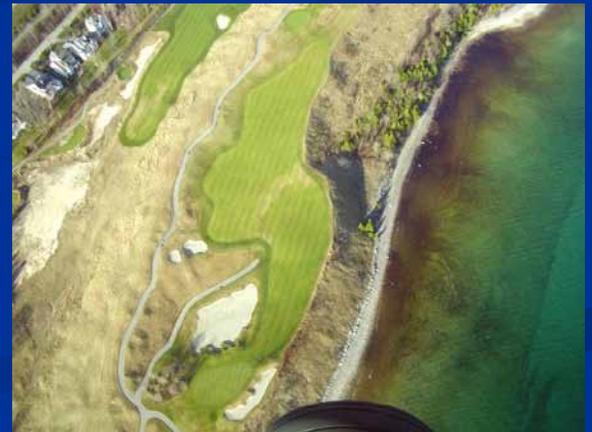
PFIB



ERT's Mission...

SUPERFUND

- Support the Nation's Response, Cleanup and Renewal of its Contaminated Land, Water and Air
- Promote Development of **Technology** and **Procedures** in Areas of Relevant Science and Engineering
- Disseminate Information
- Support the Programs within OSWER



ERT Dive Support

- Contaminated and Clean Water Dive Operations
- ERT's Divers Support a Variety of Agency Needs
 - Benthic Habitat Assessments/Coral Research
 - Survey of Ocean Dredge Disposal Sites
 - Environmental Criminal Investigations
 - Sunken Drums
 - Multimedia Aquatic Sampling
 - SUPERFUND Assessments



ERT SOPs and Plans

- Unit Specific SOPs and Guidelines Based on Expected Diving Conditions
- ERT Standard Operating Procedures (SOPs) and Plans:
 - Diver Contamination Procedures SOP
 - Dry Suit Diving SOP
 - Surface Supplied Diving Operations SOP
 - Dive Operation Safety SOP
 - Dive Plan and HASP (for contaminated water dives)



EPA Dive Plan Elements

- Approval and Review by UDO and Health and Safety Officer

- Introduction

- Dive Operation Guidelines

- Responsibilities Of Dive Personnel

- Personnel

- Safety Equipment

- Dive Objectives/Methods

- Dive Conditions

- Physical Hazards

- Biological Hazards

- Chemical Hazards

- Dive Equipment

- Decontamination Plan

- Communication Plan

- Emergency Evacuation Plan

- Emergency Contact Numbers

- Appendices

- Dive Tables

- Dive Logs

- Dive Plan Briefing And Checklists

- Diving Accident Management

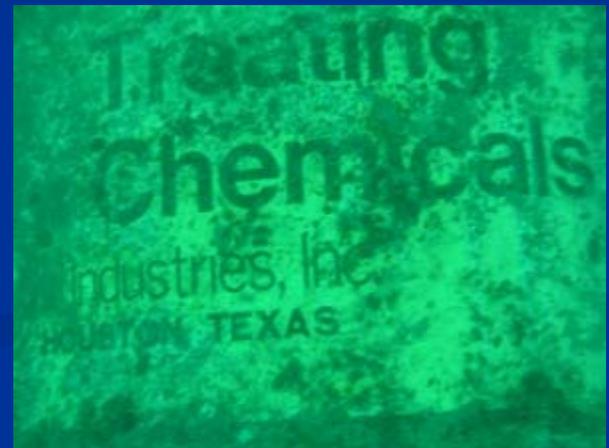
Site Hazards

- Known vs. Unknown (Unanticipated) Sources
- Physical Hazards
- Biological Hazards
- Chemical Hazards



Chemical Contaminants

- Metals
- Volatile Organic Compounds (VOCs)
- Polychlorinated Biphenyls (PCBs)
- Dioxins
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Pesticides/Herbicides



Chemical Contaminants

Chemical Properties

- Water-borne/Water Soluble Contaminants
- Non-Soluble
- Contaminant Density
 - Floaters (Gas, Some Oils)
 - Sinkers (PCBs, Metals)
- Adherence to Sediments
- Persistent Contaminants
- Releases
- Water Reactive



Chemical Contaminants

Routes of Exposure

- Inhalation
- Ingestion
 - Full Face Mask/Helmet
- Skin Contact
 - Dry Suit



Chemical Contaminants

CAMEO Chemicals

Chemical Datasheet

[Add to MyChemicals](#)

[Print Friendly Page](#)

ARTICLES CONTAINING POLYCHLORINATED BIPHENYLS (PCB)



[Chemical Identifiers](#) | [Hazards](#) | [Response Recommendations](#) | [Physical Properties](#) | [Regulatory Information](#) | [Alternate Chemical Names](#)

Chemical Identifiers

[What is this information?](#)

UN/NA Number

[2315](#)

CAS Number

11096-82-5
11097-69-1
11104-28-2
11141-16-5
12672-29-6
12674-11-2
1336-36-3
~~53469-21-9~~

CHRIS Code

[PCB](#)

NFPA 704: Red 1 -- Flammability: Must be preheated to burn
Blue 2 -- Health Hazard: Hazardous - use breathing apparatus
Yellow 0 -- Reactivity: Normally stable

General Description

PCBs are colorless oily liquids. Much denser than water and insoluble in water. May burn under exposure to intense heat or flames for prolonged environment and potential for long term chronic environmental and health risks. Immediate steps should be taken to limit spread to the environment and nearby waterways.

Hazards

[What is this information?](#)

Reactivity Alerts

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

Special Hazards of Combustion Products: Irritating gases are generated in fires. (USCG, 1999)

Health Hazard

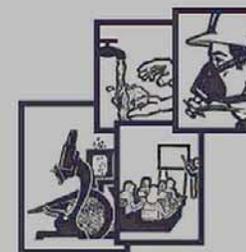
Acne from skin contact. (USCG, 1999)

Reactivity Profile

POLYCHLORINATED BIPHENYLS are incompatible with the following: Strong oxidizers (NIOSH, 1997).

Belongs to the Following Reactive Group(s)

- [Haloogenated Organic Compounds](#)



NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Full Face Mask/Helmet

- Full Face Mask

- Positive Pressure
- Second Stage Regulator Reliability
- Ease Of Decontamination
- Dry Suit Hood Mask Seal Potential For Leaks
- Leak Test At Start Of Dive

- Helmet

- Most Protective/Best Seal with Dry Suit
- Positive Pressure
- Second Stage Regulator Reliability
- Ease Of Decontamination
- Must Be Mated With Dry Suit – No Neoprene (Wet) Seal
- Hygienic Issues If Shared Among Dive Team
- More Protective Double or Quad Exhaust Valve



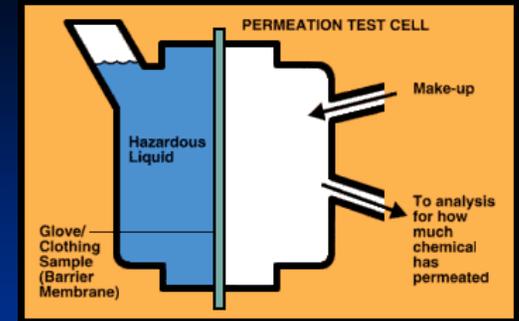
Dry Suit

- Vulcanized Rubber Routinely Used
 - Smooth Surface Minimizes Adherence Of Contaminants
 - Easier To Decontaminate
- Nylon Or Other Coated Fabric Dry Suits
 - Difficult To Decontaminate
 - Less Resistant To Chemical Permeation
- Smooth Polyurethane Exterior May also be Suitable
- Easy To Patch/Repair In The Field
- Permeation Testing Data Should Be Available and Consulted
- Abrasion Resistance Testing
- Double Exhaust Valves
- Mated Dry Gloves with Abrasion Resistant Outer Glove



Dry Suit Testing

- Permeation Testing Independently Using ASTM Methods
 - Tests Performed on Pristine Material and under Laboratory Conditions
 - Test Results Do Not Represent Realistic Usage Conditions
 - Tests Shown are for Suit Material Only
 - Additional Test Data may also be Available
 - Seams, Wrist/Face Seals, Gloves or Patches may be Weakest Link in Gear
- For Some Chemicals There is NO Suitable Dry Suit Available
 - Carbon Disulfide <1 minutes
 - Dichloromethane <5 minutes
- Penetration/Abrasion Resistance is also Critical



Comparison of Permeation Data

Chemical	Solubility In Water	Test Concentration (%)		Break Through Time (minutes)	
		Viking PRO	Whites HazMat	Viking PRO	Whites HazMat
Acetone	100	10	100	50	13
Acetonitrile	100	100		>180	90
Ammonia Solution	100	10		>180	>480
Carbon Disulfide	0.2	100	98	1	0
Dichloromethane	1.3	100		5	4
Diethylamine	82	10	100	>180	45
Ethyl Acetate	8.7	8.7	100	20	>480
Sodium Hydroxide	50	10	50	>180	>480
ISO Liquid C	Not Soluble	100		10	61

ISO Liquid C simulates high octane gas (50% isooctane & 50% toluene)

Decontamination Plan

- Included in Dive Plan or Health and Safety Plan (HASP)
- COMPLEXITY OF PLAN IS CONTAMINANT SPECIFIC
- Define Decontamination Zones on Site Map
- Personnel
- Equipment and Supplies
- PPE
- Waste Disposal
- Wind Direction
- Site Logistics

Decontamination Plan:

Surface Personnel (Decon): (None Required Level B C D)

Outer Protective Suit (Tyvek Saranex Baticade Other: _____)
 APR (Cartridge: _____)
 SCBA
 Booties
 Surgicals
 Outer Gloves: _____
 Full Face Mask
 Hard Hat
 Steel Toe/Shank Boots

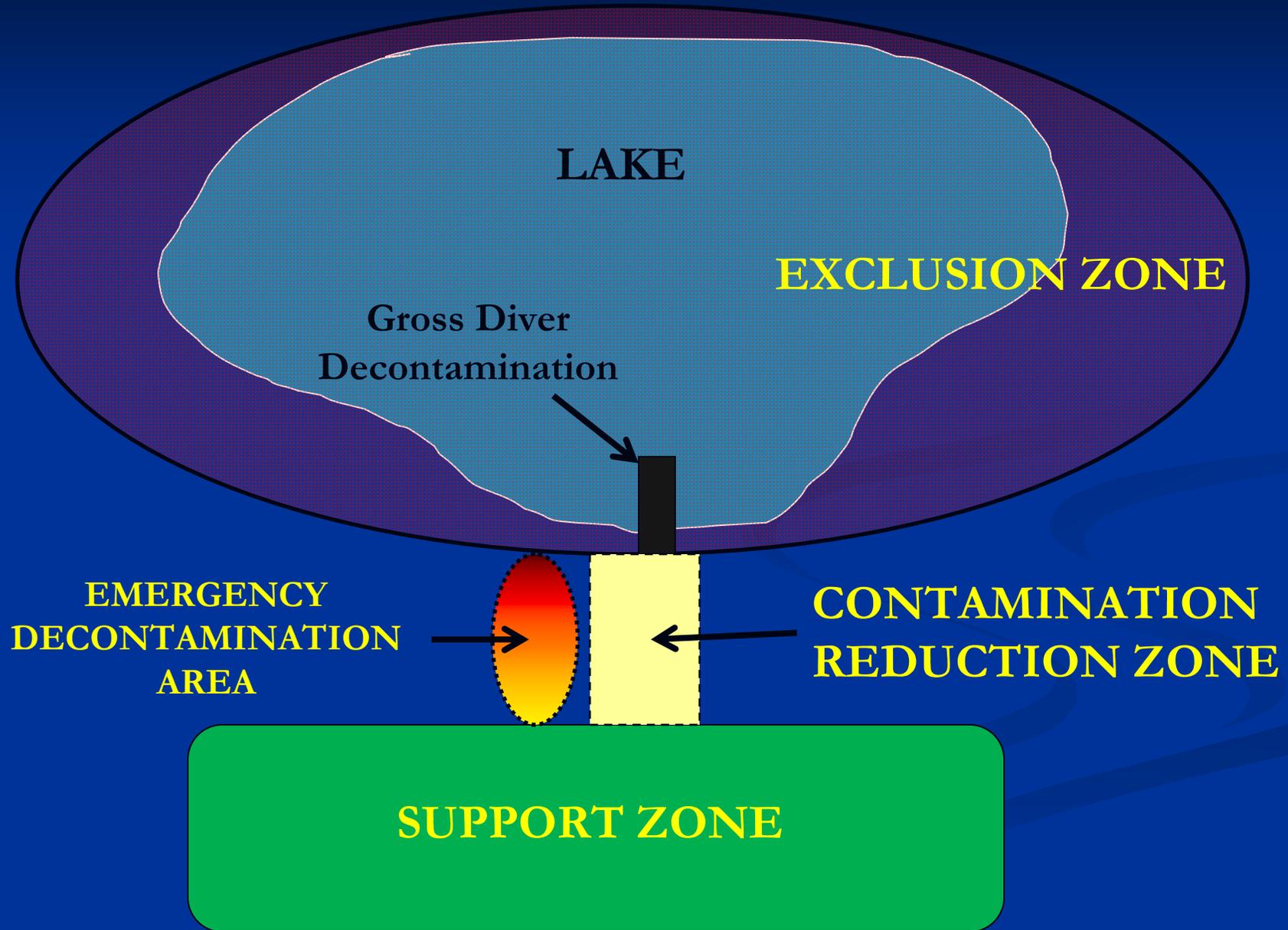
Decontamination Procedure:

Step 1 Rinse with potable water
Step 2 Wash with soapy water
Step 3 Rinse with potable water

Describe disposition of wastes: Rinse will be perform



Decontamination



Decontamination Zones

- EXCLUSION ZONE (EZ) OR HOT ZONE

- Work Area
- PPE Required to Enter/Decontamination Required When Exiting the EZ

- CONTAMINATION REDUCTION ZONE (CRZ)

- Decontamination Line (Linear – One Direction)
- Pass Through Between the EZ and the SZ
- Must Wear Proper PPE

- SUPPORT ZONE (SZ)

- Clean Area Outside the EZ and the CRZ.

- EMERGENCY DECONTAMINATION AREA

- Separate Area Between the EZ and SZ for Emergency Decontamination of Injured Diver



Decontamination Supplies

- Potable Water
- Decontamination Solutions
- Soft Bristled Brushes/Sponges
- Paper Towels
- Plastic Sheeting
- Hudson Sprayer
- Decontamination Shower
- Disinfectant Wipes
- Chemical/Water Resistive Suits
- Face Shields/Eye Protection
- Gloves/Boot Covers
- Boots
- Other PPE
- Basins/Containers/Buckets

Decontamination

- REMOVAL VS. DESTRUCTION/NEUTRALIZATION OF CONTAMINANTS
 - Removal of Contaminants from Gear Prior to Undressing
 - Consider Safety of Decontamination Solution Relative to Contaminants Present
 - May Not be Necessary to Neutralize Chemical Contaminants or Kill Biological Contaminants
 - Additional Decontamination May Be Performed After Diver Removes Gear
 - If Contaminants Aren't Neutralized or Destroyed Decontamination Fluids May Need to be Contained



Decontamination Solutions

The major considerations when choosing a decontamination solution are:

1. Effectiveness on Site Contaminants
2. Compatibility with Gear
3. Safety to Diver and Support Personnel
 - Always Consult MSDS
 - HMIS Health Rating of 1 or Less
4. Availability and Cost
5. Biodegradable Decontamination Solutions
6. Containment And Disposal of Used Decontamination Solutions
 - Non-biodegradable Solutions
 - Solutions Containing Contaminants Not Neutralized or Destroyed



Decontamination Solutions

WATER

- Most Important Solution Used Alone or in Conjunction with Other Solutions
- Large Supply
- Low-pressure Hose or Decontamination Shower
- Municipal Water Supply or Large Water Tank
- First and Last Step of All Decontamination
- High Pressure (>70 psi) may:
 - Damage Equipment
 - Force Contaminants into Seams
 - Contaminate Nearby Surface Support Personnel.



Decontamination Solutions

COMMERCIAL SOAPS/CLEANING SOLUTIONS

- Strong Soap Solution Second Most Commonly Used Solution
- Numerous Products
 - Synthetic Ingredients
 - Natural Active Ingredients
- Selecting Appropriate Soap/Cleaning Solution
 - Surfactant Effectiveness
 - Antimicrobial Properties
 - Triclosan
 - Biodegradability
 - Safety



This Industrial Material Safety Data Sheet is not intended for consumers and does not address consumer use of the product.

Palmolive Dishwashing Liquid Ultra and Antibacterial Hand Soap

Effective Date: August 20, 2004

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

COLGATE-PALMOLIVE COMPANY Commercial Customer Group 191 East Hanover Avenue Morristown NJ 07960-3131 PRODUCT NAME: Palmolive Dishwashing Liquid Ultra and Antibacterial Hand Soap CAS NUMBER: Not applicable – product is a mixture GENERAL USE: Formulated liquid detergent for hand dishwashing.	EMERGENCY TELEPHONE NUMBER: For emergency involving spill, leak, fire, exposure or accident, call CHEMTREC (800) 424-9300, day or night. For MEDICAL EMERGENCIES involving this product call (800) 424-3001.
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2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA-REGULATED COMPONENTS (present at a concentration of > or = 1%):				The following components, present at a concentration of > or = 0.1%, are listed as carcinogens or potential carcinogens by either the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC) or OSHA.					
Component	CAS#	%	PEL	TLV	Component	CAS#	%	PEL	TLV
Ethanol	64-17-5	5-10	1000 ppm	1000 ppm					

3. HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS

EYE CONTACT: Causes eye irritation on direct contact.

SKIN CONTACT: May cause skin irritation on prolonged or repeated contact.

INGESTION: May be harmful if swallowed in large amounts.

INHALATION: No adverse effects expected.

4. FIRST AID MEASURES

EYE CONTACT: Flush eyes with large amounts of water for 15 minutes. Get medical attention if irritation persists.

SKIN CONTACT: Rinse area with plenty of water. Get medical attention if irritation persists.

INGESTION: Drink 1-2 glasses of water. Get medical attention.

INHALATION: Not Applicable.

5. FIRE FIGHTING MEASURES

Flash Point (Method): 137F (Orange), 141F (Lemon)

Extinguishing Media: Water spray, all-purpose dry chemical, CO2.

Palmolive Dishwashing Liquid Ultra and Antibacterial Hand Soap

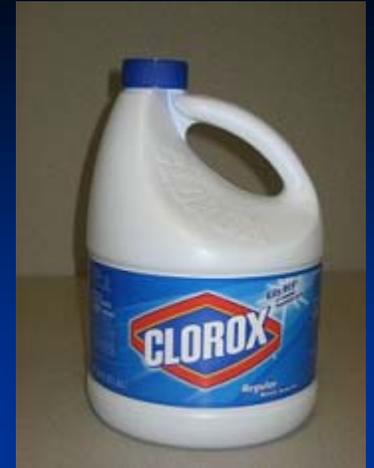
Decontamination Solutions

EXAMPLES OF COMMERCIAL SOAPS/CLEANING SOLUTIONS

- Simple Green® All-Purpose Cleaner - general all purpose cleaner/degreaser
- Citrus Klean - natural citrus based cleaner/degreaser
- BioSol - Organic solvent degreaser
- ZEP Big Orange - natural citrus based cleaner/degreaser
- ZEP Acclaim - liquid hand soap
- Orange Blossom - natural citrus based cleaner/degreaser
- Citrus Magic - natural citrus based cleaner/degreaser

Decontamination Solutions

BLEACH (SODIUM HYPOCHLORITE)



- Sodium Hypochlorite (Chlorine Bleach) is Readily Available
- Household Bleach is About 6% Sodium Hypochlorite
- 10% Solution of Household Bleach and 10 minute “Wet” Contact Time is Recommended for Decontamination
- If Significant Biological Hazards are Present it May be Useful to Soak Gear After Removal
- Bleach Can Be Hazardous to Diver and Degrade Some Equipment

Decontamination Solutions

BETADINE

(IODINE BASED SOLUTION)

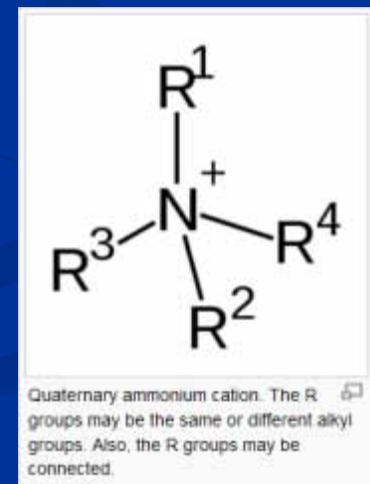


- Betadine is a 10% povidone-iodine solution
- Commonly Used in Hospitals to Disinfect Wounds/Skin
- Undiluted Betadine Will Kill Most Pathogens After 10 minutes of “wet” contact time.
- Pre-mixed Solutions with an Added Cleaning Agent such as Multi-Wash™ Mini have been Tested and are Commercially Available
- Not Ideal for Primary Diver Decontamination but is Very Effective in Cleaning and Disinfecting Certain Types of Dive Gear such as Full-Face Masks

Decontamination Solutions

QUATERNARY-AMMONIUM COMPOUNDS (QUATS)

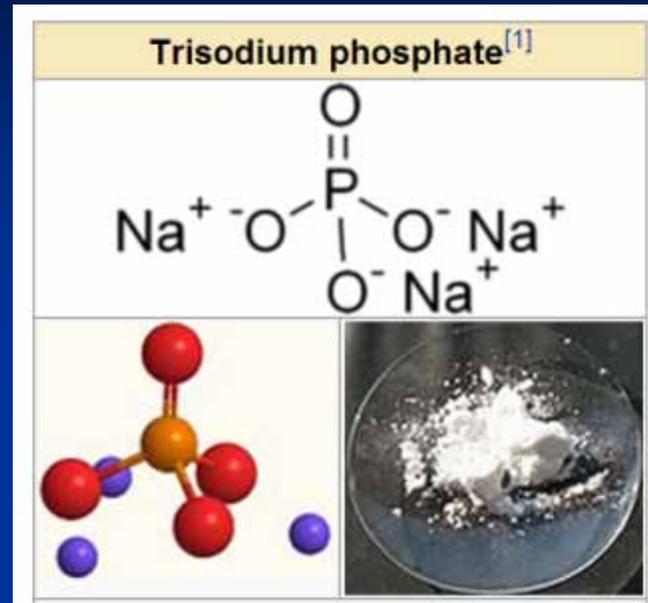
- Many Commercial and Household Cleaners Contain Quats
- Primarily Used for Sanitizing General Household Areas and Kitchens
- Quats are Highly Toxic to Aquatic Organisms
- Quats are Corrosive to Skin and Eyes
- Appropriate PPE and Disposal of Decontamination Fluid is Necessary
- Not Recommended as a Primary Decontamination Solution, But May Have Limited Uses



Decontamination Solutions

TRI-SODIUM PHOSPHATE (TSP)

- Strong Cleaner/Degreaser.
- TSP Typically Used To:
 - Prepare Surfaces for Painting
 - Remove Mildew
 - Remove Stains from Patios or Driveways.
- TSP will Stain Metals and can Etch Glass and Fiberglass
- Hazardous to Diver and may Degrade Dive Equipment
- Not Recommended as a Primary Decontamination Solution, May Have Limited Uses



Decontamination Solutions

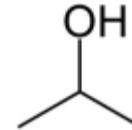
ALCOHOL

- Isopropyl Alcohol is a Good Biocide
- Not Appropriate for Decontaminating the Diver's Entire Suit and Equipment
- Ideal for Wiping Down the Areas Under the Seals of the Diver's Full Face Mask



Physical data

Appearance: colourless liquid with slight alcohol odour
Melting point: -89 C
Boiling point: 82 C
Vapour density: 2.1
Vapour pressure: 33 mm at 20 C
Specific gravity: 0.79
Flash point: 12 C
Explosion limits: 2.0 % - 12 %
Autoignition temperature: 425 C



Stability

Stable. Incompatible with strong acids, strong oxidizing agents, halogens, aluminium, active halogen compounds. Regulated in UK under Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972. Highly flammable. Vapour-air mixtures may be explosive. May react with oxygen in the air to form peroxides.

Toxicology

May be harmful by inhalation, ingestion or skin absorption. May act as an irritant. UK OES Long-term 980 mg/m³.

Toxicity data

(The meaning of any abbreviations which appear in this section is given [here](#).)

ORL-RAT LD50 5045 mg kg⁻¹
SKN-RBT LD50 12800 mg kg⁻¹
ORL-MUS LD50 3600 mg kg⁻¹
ORL-MAN TDLO 223 mg kg⁻¹
IVN-DOG LDLO 5120 mg kg⁻¹
Pimephales promelas LC50 11130 mg/l/96h
Daphnia magna LC50 9500 mb/l/24h

Decontamination Solutions



DF-200

- Recently Developed For Neutralizing Chemical and Biological Warfare Agents
- Environmentally Safe
- Work on a Wide Range of Material Surfaces
- Contact Times Ranging from 1 to 30 Minutes
- EasyDECON™ by Intelagard
- Effective in Neutralizing Some Chemicals
- Also Contains a Surfactant
- Most Expensive
- Not Readily Available – Must Be Ordered Ahead of Time



EPA Polluted Water Diving Summary

•TRAINING

- Must have Proper Training to Safely Conduct Planned Dive*

•DIVE PLANNING

- Do I have Suitable Background Information to Plan the Dive?*
- "No Data" Doesn't Equal Not Contaminated*
- Plan Your Dive and Dive Your Plan*

•DIVE EQUIPMENT/PERSONAL PROTECTIVE EQUIPMENT (PPE)

- The Right Gear for the Right Job - Keep the Diver Dry!*
- Conservative Approach is a Must*

•DECONTAMINATION

- Project and Contaminant Specific*
- Keeping the Divers and Tenders Safe After the Dive*

•MEDICAL MONITORING

- Did the Protocols Work?*
- What can be Improved?*

QUESTIONS ?

